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Oversight of Petroleum Systems Integrity in Alaska

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Abstract

Following pipeline leaks on the Alaskan North Slope in 2006, the state of Alaska, by executive order of the governor, responded by establishing the Petroleum Systems Integrity Office (PSIO) as the lead state agency responsible for oversight of the maintenance of facilities, equipment, and infrastructure for oil and natural gas resources in Alaska.

The executive order identified three major activities for PSIO:

- An assessment of Alaska's oil and gas infrastructure integrity;
- An assessment of current regulatory oversight in Alaska; and
- A review of industry oversight efforts.

PSIO efforts identified infrastructure components with indeterminate regulatory oversight. In addition, PSIO recommended improvements in state oversight, including establishment of minimum requirements for operators' integrity management systems and the ability to collect sufficient information to develop leading performance indicators.

PSIO was consolidated into another state agency in 2014 and its mission was suspended in 2015. Future efforts to improve policies, systems, and methods of oversight will depend on executive direction, legislative support, and emphasis within state agencies.

Introduction

In 2006 a North Slope elevated pipeline at Prudhoe Bay, Alaska leaked over 5,000 barrels of oil, making it the largest oil spill on Alaska's North Slope to-date. The 34-inch diameter pipeline, operated by BP Exploration, Alaska (BPXA), was decommissioned and later replaced with a 20-inch diameter pipeline.

This leak and a subsequent smaller leak from another BPXA-operated pipeline at the Prudhoe Bay oil field resulted in an extended partial shutdown of oil delivery from the Prudhoe Bay field to the Trans-Alaska Pipeline System (TAPS). The leaks resulted from undetected internal corrosion in the field's oil transit pipelines. Post-incident reports found that an inadequate

inspection program and ineffective corrosion inhibitor application by BPXA were the proximate causes of the corrosion and leaks.[1]

BP subsequently pled guilty to negligent discharge of oil under the federal Clean Water Act and was fined $20 million in November 2007. BP also paid a $25 million civil penalty in July 2011 and agreed to take measures to significantly improve inspection and maintenance of its pipeline infrastructure on the North Slope. In November 2012, the state of Alaska announced it would collect $255 million from BP related to state revenue losses from the resulting field shutdown.

From a regulatory perspective, the pipelines that leaked were not under the oversight of either federal or state authorities. The pipelines were of a category (low stress, rural) that was exempt from federal oversight, and the state of Alaska does not have its own pipeline safety program. Although this regulatory gap was not the primary reason for BPXA's performance problems, both the federal and state governments responded with efforts to increase regulatory control.

The federal government, through the Pipeline and Hazardous Materials Safety Administration (PHMSA), promptly issued compliance orders under its emergency powers to protect life and property. PHMSA also accelerated promulgation of regulations addressing similar "low stress" pipelines.

Out of concern that other regulatory gaps may exist regarding petroleum infrastructure, the state of Alaska responded by creating the Petroleum Systems Integrity Office (PSIO) by executive order of Governor Sarah Palin.[2] This paper addresses the results of PSIO's efforts to discharge the mandate of the executive order.

The Petroleum Systems Integrity Office

The governor's executive order established the PSIO Coordinator as the state's lead official for exercising oversight of the maintenance of facilities, equipment, and infrastructure for oil and natural gas resources in the state. The order established the goals of the PSIO:

- Ensure that oil and gas infrastructure is designed and maintained in a safe and environmentally sound manner in compliance with state law;
- Minimize economic impacts of unplanned interruptions in oil and gas production to the ongoing functions of state government;
- Avoid premature abandonment of oil and gas infrastructure and waste of state resources; and
- Ensure efficient and effective oversight of oil and gas industry practices by utilizing existing state government structures and processes to the maximum extent possible.

The order identified three major activities to be executed by PSIO:

- An assessment of Alaska's oil and gas infrastructure integrity;
- An assessment of current regulatory oversight in Alaska; and
- A review of industry oversight efforts.

Each of these major activities is discussed in this paper.

Assessment of Alaska's Oil and Gas Infrastructure Integrity

PSIO's assessment was intended to identify potential threats and risks to infrastructure that may result in unacceptable consequences to Alaska's citizens, environment, or economy. The assessment, along with a review of the current regulatory structure and the petroleum industry's

risk assessment practices, provided a framework in which to evaluate oversight efforts and the integrity of Alaska's petroleum infrastructure.

Factors Influencing Infrastructure Condition

The condition of the state's oil and gas infrastructure is affected by a number of hazards and threats. Among these include the effect of aging facilities, changes in industry operations, changes in the characteristics of produced petroleum, the effectiveness of operator integrity management programs, and industry performance of appropriate maintenance activities.

As the oil and gas industry has developed, new systems have been added and older systems have been modernized or mothballed. Changes in the infrastructure have been made to increase efficiency and production, to improve system integrity, and to adapt to changes in field characteristics – all concurrent with advancements in oil and gas science and technology.

The current condition of the infrastructure is a result of the combined effects of aging facilities, changes in risk profile, the adequacy of operations and maintenance practices, and government oversight emphasis. Factors that negatively affect infrastructure condition are primarily undetected changes in threat exposure and subsequent inadequate maintenance programs to address these new threats.

Aging Facilities

The useful life of a facility or pipeline is virtually unlimited, given the execution of appropriate maintenance, repair, and replacement programs.[3] However, as infrastructure ages the need for vigilance in such programs increases.

Infrastructure reliability issues typically follow a life cycle that can be represented by a "bathtub curve" wherein an early-life break-in period is followed by a period of steady operation, which is in turn followed by a period of increasing failure rates.

However, some threats to system integrity, such as corrosion, are time-dependent and increase as a facility ages. Internal corrosion has caused leaks in pipelines in Cook Inlet and the North Slope and appears to be more prevalent in older pipelines.[4]

Likewise, external corrosion in the Prudhoe Bay and Kuparuk oil fields is exacerbated by design decisions made in the early days of development that left some insulated field pipeline joints uncoated and exposed to corrosive atmospheric conditions. There are extensive "find and fix" programs underway in the North Slope oil fields where this design abides.[5]

Changes in Risk Profile

Most of the state's oil and gas infrastructure has been in place for decades. Over time, the physical characteristics of the petroleum production streams have changed, requiring operators to continually assess, monitor, and/or modify systems to be appropriate for changed operating conditions. If this continuous assessment process is not well-executed, the original design basis for some systems may not be appropriate for current conditions and may result in an increased risk of failure.

For example, North Slope oil production has been decreasing for a number of years. The 2006 BP oil spills were partially a result of an unrecognized change in risk due to lower flow rates that contributed to solids accumulation in oil transit pipelines. The accumulated solids blocked detection and mitigation of active corrosion cells. Although adequate maintenance pigging and

use of chemical corrosion inhibitors are two primary means to control and mitigate internal corrosion, the lack of a subsequent adjustment in maintenance practices resulted in these integrity breaches.

In an effort to adapt to changes in risk, the operators of the trans-Alaska pipeline (TAPS) are studying hazards and threats related to operating at low flow rates in cold conditions, due to declining North Slope oil production. Significant changes in TAPS infrastructure and operating practices will be required to address the changing conditions.[6]

New Industrial Operators

Development of infrastructure in remote areas of Alaska has lowered the cost barriers to entry of new companies to explore for opportunities and to operate older fields that are acquired from the initial developers. This change, while a welcomed development for the economic health of the state, could potentially increase risks from new operations that may not have been proven for arctic or sub-arctic conditions, and from new operators that may have varying levels of integrity management and quality assurance systems in place.

Emphasis in Government Oversight

Regulatory oversight in the petroleum industry has changed with emerging issues, but the changes typically are reactive rather than proactive. This reactive nature of regulatory change is a natural reflection of the limited ability of any regulatory structure to anticipate change in the character of threats. Traditional regulatory values of fairness, consistency, proportionality, and predictability are sometimes at odds with a proactive approach.[7] The result is a regulatory lag as rulemaking and due-process efforts "catch up" to emerging threats and changes in hazard exposure.

Regulators can use a risk identification process to anticipate changes in hazard exposure and to help focus regulatory emphasis. However, the use of risk assessments to anticipate change in risk, while appropriate for the operator of the infrastructure, can be problematic if used by regulators without the necessary tools for assessment. Risk assessments are ephemeral, data-intensive, and require regular updating to develop trends and identify problem areas.[8]

Regulators should nevertheless ensure that an operator's risk management processes are effective and available to the regulator in order to understand the risk assessments and threat mitigation measures used by the infrastructure owner. Development and oversight of minimum standards of effective operator integrity management programs is a key way to ensure that risks are mitigated to the greatest extent feasible.[9]

Assessment of Regulatory Oversight

To address this mandate, PSIO reviewed state regulatory oversight of petroleum systems infrastructure. Federal oversight was not included in this assessment. This effort is described below and comprised of three steps:

- Identify state agencies' regulatory authorities and practices;
- Identify potential oversight gaps; and
- Develop prioritized corrective actions based on risk.

Identification of Agency Authorities and Practices

A review of the regulatory framework governing safe operation of Alaska's oil and gas infrastructure is useful as a baseline for determining if the existing authorities are appropriate for current conditions. In broad terms, this regulatory assessment focused on oil and natural gas production systems from the wellhead to the point where hydrocarbons are either loaded onto tanker vessels for shipment out of state or at the point of transfer to a refinery.

Designated state government agencies are identified in the executive order as agencies that regulate aspects of oil and gas operations. Liaison officers from these agencies serve as the primary point of contact representing their respective agency and coordinate directly with the PSIO coordinator.

Through the liaison officers, agencies were requested to identify the statutes, regulations, or other legally authoritative documents or orders that define their authority or confer responsibility over petroleum systems/facilities. PSIO used this information to identify and document each agency's intent, responsibilities, programs, jurisdiction, and compliance/enforcement tools.

Identification of Potential Regulatory Oversight Gaps

Each designated agency was requested to list and describe any known authority or responsibility that is duplicative or that conflicts with those of another state or federal agency, and to identify any known gaps in existing authority or jurisdiction. PSIO reviewed the agency-identified gaps through a verification and validation process that included an independent review of statute, regulation, and other authoritative documentation to ensure that all regulatory or oversight powers were identified.

The use of "gap" terminology can be problematic in analyzing the regulatory regime in Alaska. Identification of a "gap" could imply that there is a preferred regulatory framework for oil and gas infrastructure that serves as a baseline for comparison, and in comparison Alaska's framework contains gaps. There is no such framework for comparative benchmarking, and likely should not be, since the organizing of state laws and regulations around an infrastructure-based schema could lead to complexity and unintended adverse consequences. However, the "gap" terminology can be useful as shorthand for identifying areas of jurisdictional uncertainty and opportunities for improvement.

Prioritization of Gaps

Two primary categories of gaps were defined, as follows:

- A jurisdictional gap is defined as a situation in which no state agency has a program or authority to oversee an infrastructure type or activity, as well as a situation when a state agency has only partial or limited authority; and
- A process gap is defined as a shortcoming in the process that an agency uses to execute its statutory authority. Identification of a process gap is somewhat subjective and occurs when a particular authority is not well-executed because of inadequate execution processes, lack of resources, or competing program priorities.

Process gaps are generally corrected by continuous improvement efforts by the individual agencies. All agencies have internal goal-setting and process review programs, and focus areas are usually set by the executive branch and legislative budget priorities. Process gaps were identified in this assessment, but only as an effort to help agencies focus internal improvement strategies.

Jurisdictional gaps, on the other hand, require a corrective action that reduces risk of a specific threat. Consequently, this assessment focused on jurisdictional gaps.

A potential gap in oversight does not necessarily imply a risk to the state. If oversight is not exercised on a given facility, the risk to infrastructure integrity may indeed increase. However, if oversight is not exercised as intended, but compensating agency processes are in place, then the risk to infrastructure may be mitigated.

To identify gaps of the greatest importance to the state, a qualitative impact analysis (QIA) was used to organize and consolidate the gaps. The QIA methodology ranked the impacts associated with gaps by using a team of in-house experts and a structured framework. Based on the outcome of the QIA, gaps were placed in "buckets" of impacts: High, Medium, Low, and Very Low. This priority ranking helps focus actions and target resources to correcting the gaps that present the greatest potential impact.

Assessment Findings

The assessment determined that some petroleum system infrastructure components are operated without clearly defined state oversight roles, including:

- Offshore platform structures;
- Pipelines and facilities carrying natural gas; and
- Pipelines authorized under non-common carrier easements.

The risk from this oversight uncertainty may be partially mitigated by concomitant federal oversight of some of these systems. However, since federal oversight was not included in this assessment, the degree of risk and level of mitigation is indeterminate.

Corrective Actions for Improved Regulatory Oversight

In general, oversight gaps may be closed or otherwise mitigated in a number of ways:

- The agency can propose new statutes or regulations;
- Agencies can develop memoranda of agreement or understanding to coordinate their activities;
- The agency can adopt standardized and formal business practices; and/or
- The agency can develop remedies through mitigation measures currently allowed by regulation.

PSIO used this assessment to identify areas for improved regulatory oversight and to develop prioritized corrective actions based on risk. These efforts included the following:

- PSIO led a project with agencies to unify oversight over all petroleum pipelines. Some pipelines were seen to be outside the safety regulations of state and federal agencies. These pipelines are authorized by the state as a permitted land use, but safety oversight needed improvement.
- To improve consistent application of safer designs, PSIO clarified the "practice of engineering" as defined in Alaska statutes regarding lessee/operator submittals to state agencies. PSIO recommended that professional engineers registered in Alaska design oil and gas facilities submitted for agency reviews.
- PSIO proposed new mitigation measures for future lease sales that would require lessees to describe how expected risks associated with the lessee's activities will be identified,

managed, and minimized. A key element of these measures would require lessees to demonstrate a management system that controls processes for risk assessment, data collection, and incident investigation.

PSIO also identified opportunities that would improve agency coordination and facilitate improved data collection for trending analysis. PSIO contracted with the Mary Kay O'Connor Process Safety Center at Texas A&M University (MKOPSC) to provide technical assistance on a number of projects, including development of:

- Investigation protocols for independent root cause analyses of future oilfield incidents and accidents;
- An operator management systems assessment program for lessees; and
- A plan for tracking and trending system infrastructure conditions on state lands.

Review of Industry Oversight Efforts

The restrictions upon state agencies, by statute or regulation, that limit sharing of confidential information with PSIO and each other made the industry evaluation mandated by the executive order unattainable. The operators are not required by statute or regulation to provide operational data directly to PSIO and therefore declined to provide data that is not publicly available.

Instead, PSIO conducted a data review of available public information regarding performance of Alaska's oil and gas producers and operators. PSIO's designated agencies assisted this effort by providing non-confidential data on performance characteristics of the state's oil and gas infrastructure.

This data review found that no single agency in the state collects, aggregates, and reports information that would facilitate a coordinated approach to oversight of oil and gas industry performance. In addition, individual agency "data silos" can form that constrict access to information by other agencies, primarily due to a lack of confidentiality agreements among state agencies.

Overall Recommendations

PSIO submitted recommendations for improved state oversight to the liaison agencies.[10] Among them was a recommendation to establish minimum requirements for operators' integrity management systems. Without the ability to verify compliance with these requirements, the integrity profile of petroleum infrastructure may be indeterminate to state regulators.

The recommendations also called for new oversight tools that include the ability to collect sufficient information to develop leading performance indicators and to monitor trends, which in turn would lead to improved policies, systems, and methods of oversight.

Upon completion of a comprehensive review of state oversight practices, PSIO was consolidated with the state Pipeline Coordinator's Office in 2014 to allow resources to be applied to infrastructure requiring additional focus.[11] The emphasis for PSIO's mission shifted to establishing consistent oversight of the assessment-identified set of indeterminate infrastructure: non-common carrier pipelines, natural gas pipelines, and offshore production platforms in state waters.

Conclusion

The mission of PSIO was suspended in 2015 as a result of budget reductions and reallocation of resources.[12] With increasing pressure on future operating budgets, the ability to provide appropriate oversight will depend on development of efficient and effective regulatory tools and inter-agency cooperation.

Future efforts to improve policies, systems, and methods of oversight will depend on executive direction, legislative support, and emphasis within state agencies. Without these efforts, it will be challenging to develop strategic regulatory reform that will support fewer incidents, a safer workforce, and a consistent revenue stream.

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